259854 RSPA CC 17121-8

CONNECTICUT YANKEE ATOMIC POWER COMPANY

HADDAM NECK PLANT
362 INJUN HOLLOW ROAD • EAST HAMPTON, CT 06424-3099

June 12, 2002
CY-02-084

Ref. 49CFR107 & 49CFR173
Exemption No. 12468
Application No. 37506

Associate Administrator for Hazardous Materials Safety
Research and Special Programs Administration
Attention: Exemptions, DHM-31
U.S. Department of Transportation
400 7th Street, SW
Washington, D.C. 20590-0001

Haddam Neck Plant
Request for Modification to Exemption for the
Shipment of Reactor Vessel

In our letter of March 30, 2000, Connecticut Yankee Atomic Power Company (CYAPCO) requested exemption from specific regulations for the shipment of the Haddam Neck Plant (HNP) reactor vessel within a Reactor Vessel Transport System (RVTS) from the HNP site to the low-level radioactive waste burial site at Barnwell, South Carolina. The exemption, issued by the U.S. DOT on November 17, 2000, allows the shipment of the RVTS as an IP-2 package containing a reactor vessel and its internals that are classified as LSA-III.

The purpose of this letter is to request a modification of the existing exemption to (a) reflect changes in the configuration of the RVTS and associated technical data, and (b) reflect a change in the projected date of shipment and the expiration date of exemption certificate. All other aspects of DOT Exemption No. 12468 are as issued on November 17, 2000. Associate Administrator for Hazardous Materials Safety

To support review of this request, the following Enclosures are included.

Enclosure 1 – Revised Attachment 1: Compliance Matrix
Enclosure 2 – Addendum to Transport System Description Report
Enclosure 3 – Addendum to Reactor Vessel and Internals Characterization Report

The Transportation and Emergency Response Plan (included as an attachment in the original application) is unchanged.

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In general, the differences from the previously approved RVTS configuration are:

- Absence of the reactor vessel head (previously planned for attachment to the exterior of the RPV canister) and corresponding modifications of the closures for penetrations in the top of the canister.
- Absence of reactor vessel nozzles and reactor vessel insulation from the materials within the reactor vessel.
- Reversal of the RPV canister in the RVTS cradle to more evenly distribute the cradle footprint loads.

As was the case for the previously described configuration, the package of the RVTS contains radioactive waste that is (a) categorized as LSA III material for transportation and (b) classified as 10 CFR 61 Class C waste for disposal. Additionally, as previously described, the RVTS will provide a package/transport system with an equivalent safety level to that of a DOT Industrial Package Type 2 (IP-2).

The RVTS will be transported under a DOT exemption pursuant to 49 CFR Part 107.105 via barge to the Savannah River Site (SRS) in Aiken, South Carolina and via land transporter from SRS to Barnwell. This shipment will be exclusive use, one-time only, and will be performed in accordance with the transportation plan included in our previous application. The current project schedule reflects the shipment to occur on or after April 1, 2003.

We are prepared to meet with you to discuss this request and respond to any questions. If additional information is required, please contact Mr. G. P. van Noordennen, Manager of Regulatory Affairs, at (860) 267-3938.

Sincerely,

Gerard van Noordennen for
Noah Fetherston
Site Manager

Enclosures:

Enclosure 1 – Revised Attachment 1: Compliance Matrix
Enclosure 2 – Addendum to Transport System Description Report
Enclosure 3 – Addendum to Reactor Vessel and Internals Characterization Report

cc: R. Boyle, Office of Hazardous Materials Technology, US DOT
S. Hedgeworth, Document Center, US DOT (2 copies)
Y. Diaz-Sanabria, NRC Project Manager, Haddam Neck Plant
E.L. Wilds, Jr., Director, CT DEP Monitoring and Radiation Division
Document Control Desk, U.S. NRC

ENCLOSURE 1

REVISED COMPLIANCE MATRIX

HADDAM NECK PLANT

REACTOR PRESSURE VESSEL

Note #1: Bolding of text identifies specific revisions from Compliance Matrix of original application.

Note #2: Brackets identify location of specific revision that is limited to deletion of text from original Compliance Matrix.

ATTACHMENT 1
REVISED COMPLIANCE MATRIX

EXEMPTION REQUEST FROM THE PACKAGING REQUIREMENTS OF 49CFR 173 FOR THE SHIPMENT OF THE HADDAM NECK PLANT (HNP) REACTOR VESSEL TRANSPORT SYSTEM

For ease of review and processing, this exemption request was prepared under the guidelines of 49CFR 107.105 in effect as of October 1, 1999.

49CFR 107.105:	Application for exemption.
49CFR 107.105(a):	General
49CFR 107.105(a)(1):	The requested need date for this modified exemption is **October 1, 2002**
	Two copies of this exemption have been delivered to: Associate Administrator for Hazardous Materials Safety Research and Special Programs Administration U.S. Department of Transportation 400 7th Street, SW Washington, D.C. 20590-0001 Attention: Exemptions, DHM-31
49CFR 107.105(a)(2):	The correct applicant name, address and responsible agent for this exemption is: Applicant: Connecticut Yankee Atomic Power Company (CYAPCO) 362 Injun Hollow Road East Hampton, CT 06424-3099 Attention: Mr. G.P. van Noordennen Regulatory Affairs Manager Telephone: (860) 267-3938 Contractor: Bechtel Power Corporation (BPC) Decommissioning Operations Contractor Haddam Neck Plant 362 Injun Hollow Road East Hampton, CT 06424-3099 Attention: Mr. **Peter A. Labarta** Project Engineer Telephone: **(860) 267-3587**

ATTACHMENT 1
REVISED COMPLIANCE MATRIX

EXEMPTION REQUEST FROM THE PACKAGING REQUIREMENTS OF 49CFR 173 FOR THE SHIPMENT OF THE HADDAM NECK PLANT (HNP) REACTOR VESSEL TRANSPORT SYSTEM

49CFR 107.105(a)(3):	CYAPCO and BPC are United States corporations.
49CFR 107.105(a)(4):	This is not a request for a Manufacturing Exemption.
49CFR 107.105(b):	*Confidential treatment* Confidential treatment of this exemption is not requested.
49CFR 107.105(c):	*Description of exemption proposal*
49CFR 107.105(c)(1):	With regard to the transportation of one reactor vessel within a Reactor Vessel Transport System (RVTS) from the Connecticut Yankee (CY) site in Haddam Neck, CT to the low level radioactive waste burial site at Barnwell, South Carolina, the Applicant seeks relief from the requirements of 49CFR 173 as follows; PACKAGING REQUIREMENT The requirement of 49CFR 173.427(a) that low specific activity (LSA) material must be packaged in accordance with 49CFR 173.427(b) or (c). DOSE RATE AT 3 METERS The requirements of 49CFR 173.427(a)(1) regarding the 10 mSv/hr (1 Rem/hr) radiation dose limitation at 3 meters from the unshielded material. LSA III DEFINITION The requirements of 49CFR 173.403 regarding the definition of LSA-III material, which does not provide for surface contaminated LSA material.

ATTACHMENT 1
REVISED COMPLIANCE MATRIX

EXEMPTION REQUEST FROM THE PACKAGING REQUIREMENTS OF 49CFR 173 FOR THE SHIPMENT OF THE HADDAM NECK PLANT (HNP) REACTOR VESSEL TRANSPORT SYSTEM

LSA III MATERIAL LEACH TESTING

The leach testing required by 49CFR 173.468 for LSA III material which is also included in the definition of LSA III in 49CFR 173.403.

Sec 173.403 Definitions requires that LSA materials consist of Class 7 (radioactive) material with limited specific activity and the determination of such specific activities may not consider the shielding materials surrounding the LSA material. For LSA-III solids, this Section further provides:

1. That such materials meet the requirements of 49CFR 173.468, which provides detailed requirements for the LSA III leach testing and,

2. Have the Class 7 (radioactive) material "distributed throughout a solid or a collection of solid objects", and,

3. Have an average specific activity not to exceed 2x10-3 A2/g, and,

4. Consist of Class 7 (radioactive) material which is relatively insoluble so that even under loss of packaging, the loss of material by leaching in water for 7 days shall not exceed a 0.1 A2 quantity.

FREE DROP TEST

The drop orientation requirements of 49CFR 173.465(c) that IP-2 packages must satisfy the requirements of a drop test onto the target so as to suffer maximum damage to the safety features being tested.

ATTACHMENT 1
REVISED COMPLIANCE MATRIX

EXEMPTION REQUEST FROM THE PACKAGING REQUIREMENTS OF 49CFR 173 FOR THE SHIPMENT OF THE HADDAM NECK PLANT (HNP) REACTOR VESSEL TRANSPORT SYSTEM

STACKING TEST

The requirements of 10CFR 173.465(d) which requires IP-2 packages to be subjected to a stacking test for a period of at least 24 hours with a compressive load equivalent to five times the mass of the package.

49CFR 107.105(c)(2): The specific modes of transportation for this exemption request are

1) Motor Vehicle Transportation
2) Barge Transportation

The reactor vessel will be transported from the HNP facility site property by barge to the Savannah River Site (SRS) where it will then be transported by land transporter to the Barnwell facility. All transportation will be performed in accordance with the Transportation and Emergency Response Plan **as provided in original application, dated March 30, 2000.**

49CFR107.105(c)(3): A detailed description of the proposed exemptions follows as well
49CFR107.105(c)(5): as the basis for the exemption requests.

The Class 7 (radioactive) materials consist of the activated reactor vessel and the immovable activated reactor internals components which are grouted in place within the reactor vessel. These materials will be transported within a RVTS comprised of, (i) a Reactor Vessel Canister (hereinafter referred to as Canister) which provides the packaging, (ii) a tie-down system and, (iii) a Transportation and Emergency Response Plan. This RVTS provides safety equivalent to that of an Industrial Package Type 2 (IP-2) as described below.

The HNP reactor vessel with its intact grouted reactor internals, represents "a collection of solid objects" under the definition of LSA material since each reactor internals component within the vessel and the vessel itself have concentrations of Class 7 (radioactive) materials below the LSA-III limit of 2x10-3 A2/g. On average, the reactor vessel plus the internals, excluding the grout, (i.e., the Class 7 material) have a specific activity of

5.71E-6 A2/g. This specific activity corresponds to about **5.8** percent of the LSA-II limit and less than **0.4** percent of the LSA-III limit. The most radioactive individual component, bottom core barrel section (41 inches) within the reactor internals, has a specific activity of 1.57E-4 A2/g. This specific activity corresponds to less than 8 percent of the LSA-III limit.

The bases for the exemption requests are due to, (i) the unique characteristics of the Class 7 (radioactive) material to be transported, (ii) its packaging and, (iii) the administrative controls that will be implemented during transportation. The basis for each exemption requested is discussed below.

The shipment of the reactor vessel is one-time only, and therefore, demonstration of compliance to the regulations at the end of the exemption period is not required.

PACKAGING REQUIREMENT

49CFR 173.427(a) requires LSA material to be packaged in accordance with paragraph (b) or (c) of this section. For LSA III material transported as an exclusive use shipment, 49CFR 173.427(b) and Table 8 of 49CFR 173.427 would require that the vessel be packaged in an Industrial Package Type 2 (IP-2). IP-2 package design and certification requirements are stipulated in 49CFR 173.411. Under the requirements of 49CFR 173.411(b)(2), each IP-2 must meet the general design requirements of 49CFR 173.410 and prevent the loss or dispersion of radioactive material and significant increases in the radiation levels under the testing requirements of 49CFR 173.465(c) and (d) or evaluated in accordance with 49CFR 173.461(a).

The applicant proposes to transport the Class 7 (radioactive) materials using an RVTS (non-specification packaging) which provides safety equivalent to an IP-2 package when transported in accordance with its Transportation and Emergency Response Plan. **Technical data concerning** the HNP Canister and its tie-down system **is provided by the combination of: (i) the Transport System Description Report (TSDR) provided in the original**

application, dated March 30, 2000 and (ii) Addendum to the TSDR, Enclosure 2 of this application for modified exemption. The Transportation and Emergency Response Plan is **provided in the original application, dated March 30, 2000.**

The Canister provides containment of the Class 7 (radioactive) material by the following means:

- There will be closure of all reactor vessel penetrations.
- The reactor vessel interior will be filled with low density cellular concrete (LDCC) grout (25-30 lb/ft^3) to fix the surface contaminants and reactor internals components in place.
- The reactor vessel exterior surface contamination will be evaluated based on survey results. Appropriate measures will be taken to meet the LSA III requirements of 49 CFR 173.
- The reactor vessel will be placed within a steel Canister with a thickness of 3 inches for containment of the activated metals components.
- The reactor vessel will be enclosed within the Canister with a full penetration circumferential closure weld.
- **For each canister top opening that is not used for on-site rigging, a steel plug or cover plate with a thickness of at least three (3) inches will be welded into or directly over the opening. These welded plugs or cover plates will provide a seal between the Class 7 (radioactive) materials and the environs.**
- **Following on-site down-ending of the canister, the rigging studs which penetrate the canister will be cut off flush with the shear ring attached to the canister top plate. Each of the corresponding top plate/shear ring openings will be covered using three (3) inch thick carbon steel caps welded to the shear ring. These welded caps or cover plates will provide a seal between the Class 7 (radioactive) materials and the environs.**
- The annular space between the reactor vessel and the Canister will be filled with low density cellular concrete (LDCC) grout with a nominal strength of 1,000 psi and a nominal density of 70 lb/ft^3.
- The exterior of the Canister will be painted.

This robust packaging thus includes multiple provisions to prevent release of the Class 7 (radioactive) material during normal transport conditions.

The RVTS provides equivalent safety to an IP-2 package by ensuring that the Canister is designed in accordance with all the general design requirements specified in 49CFR 173.410. The Canister is also designed in accordance with the additional design requirements for IP-2 packages of 49CFR 173.465(c), and (d) within the limitations of the Transportation and Emergency Response Plan.

All HNP reactor vessel activities will be controlled by the Transportation and Emergency Response Plan, which in part requires that the HNP Canister be handled in an essentially horizontal position during all transportation evolutions. Therefore, the Canister was analyzed for a 1 foot drop in the horizontal position with a 2 foot slap down at either end as opposed to the orientation, which would cause "maximum damage to the safety features being tested." **Technical information concerning this analysis is provided by the combination of: (i) the Transport System Description Report (TSDR) provided in the original application, dated March 30, 2000 and (ii) Addendum to the TSDR, Enclosure 2 of this application for modified exemption.** Analyzing these horizontal drop scenarios is conservative for the conditions of transport regulated by the Transportation and Emergency Response Plan.

It should be noted that the transportation requirements for LSA material presented in 49CFR 173.427(a) will be met with the exception of the packaging requirements discussed above and the dose rate at 3 meters from the unshielded material specified in 49CFR 173.427(a)(1) presented below.

DOSE RATE AT 3 METERS

The unshielded reactor vessel with reactor internals within, satisfies the dose rate limitation of 10 mSv/hr as per 49CFR

173.427(a) (1). The worst case dose rate at 3 meters from the unshielded reactor vessel exterior is calculated to be 5.3 mSv/hr (530 mRem/hr). This is an estimated dose rate based on characterization results of the Reactor Pressure Vessel and internals normalized to measured survey results obtained on the thermal shield after its removal. These normalized results were further benchmarked to surveys taken on the reactor vessel exterior on contact with the mirror insulation. The reactor vessel and the reactor internals components are considered as a collection of solid objects and it has been shown above that the worst case component concentrations are well within the limitations of 49CFR 173.403. The unshielded dose rate at 3 meters from some components, if considered separately, will exceed 10 mSv/hr. However, these internal components are an integral part of the reactor vessel.

The 3 meter radiation level requirements of Sec 173.427 (a)(1):
The basis for this requirement is loss of package shielding under normal conditions of transport and the resultant dose if the package surface radiation level exceeds 10 mSv/hr at 3 meters. The worst case dose rate at 3 meters from the unshielded reactor vessel exterior is calculated to be 5.3 mSv/hr (530 mRem/hr).

Some components with the reactor vessel, by themselves, will lead to 3 meter dose rates greater than 10 mSv/hr. However, these internals components are an integral part of the reactor vessel. They are contained inside the reactor vessel itself and surrounded by grout within the vessel. Thus, even if the integrity of the Canister is breached in its entirety under normal transport conditions, the dose rate at 3 meters from any of these components could not exceed the maximum dose rate of 5.3 mSv/hr at 3 meters from the exterior surface of the reactor vessel. Surface contamination on the activated metals was accounted for in the characterization and in determining the nuclides present.

LSA III DEFINITION

The definition of LSA III material includes provisions for consideration of activated metals as LSA III, but does not specifically address activated metals which are also surface

contaminated. Although the definition does not include surface contaminated LSA material, the applicant does not believe it was intended to exclude activated metals with surface contamination. As a practical matter, any activated metals generated in a commercial reactor will have some level of surface contamination.

LSA III LEACH TESTING REQUIREMENTS

The reactor internal components and the reactor vessel interior have contaminants on their surfaces. The amount of Class 7 (radioactive) materials from surface contamination is conservatively estimated to consist of about 190 curies including about 5.2 curies of Transuranic activity. This Transuranic activity corresponds to about 149 of A2 values. These contaminants will be grouted onto their surfaces and enclosed within the reactor vessel.

The exterior surface of the reactor vessel also has surface contamination. These surface contaminants will be removed to the extent practical. Surface contamination will then be evaluated based on survey results and the appropriate measures taken to meet the LSA III requirements of 49 CFR 173. After placement of the reactor vessel within the Canister, LDCC will be placed in the annulus between the reactor vessel and the Canister.

We do not consider a scenario which could expose leachable surface contaminants to water for seven (7) days credible due to, (i) combination of the containment of the leachable radioactivity within the grout, (ii) the Canister design features and, (iii) the Transportation and Emergency Response Plan presented **in the attachments of the original application, dated March 30, 2000.**

FREE DROP TEST

Per the requirements of 49CFR 173.465(c), the package must satisfy the requirements of a drop test onto the target so as to suffer maximum damage to the safety features being tested. The drop orientation that causes *"maximum damage"* is typically one where the package center of gravity (cg) is located directly over one of the

package corners. The package's size, weight, and handling operations constrain the package to a horizontal orientation during all transport operations once outside the Containment at the HNP. Within this framework, a 1 foot flat side drop and a 1 foot horizontal drop onto either corner followed by a 2 foot slap down represents the worst case orientation during normal conditions of transport for this package. In lieu of a physical drop test, the package was analyzed under these conditions to demonstrate compliance with the free drop requirement. **Technical information concerning this analysis is provided by the combination of: (i) the Transport System Description Report (TSDR) provided in the original application, dated March 30, 2000 and (ii) Addendum to the TSDR, Enclosure 2 of this application for modified exemption.**

STACKING TEST

10CFR 173.465(d) requires IP-2 packages to be subjected to a stacking test for a period of at least 24 hours with a compressive load equivalent to five times the mass of the package. It is requested that the package be exempted from the stacking test requirement since it will be a unique one-time shipment, transported exclusive use and stacking is not credible.

49CFR 107.105(c)(4): **The current project schedule identifies the date of departure of the reactor vessel, within the RVTS, from the HNP facility site on or after April 1, 2003.** Transport to the burial disposal facility should be accomplished within 30 to 60 days. **The existing exemption expires on October 31, 2002. We request that the modified exemption for the RVTS be applicable for two (2) years from the requested approval date of October 1, 2002. This will provide allowances for any unforeseen delays.**

49CFR 107.105(c)(6): The Applicant is not requesting emergency processing under Sec. 107.117.

ATTACHMENT 1
REVISED COMPLIANCE MATRIX

EXEMPTION REQUEST FROM THE PACKAGING REQUIREMENTS OF 49CFR 173 FOR THE SHIPMENT OF THE HADDAM NECK PLANT (HNP) REACTOR VESSEL TRANSPORT SYSTEM

49CFR107.105(c)(7): Identification and description of hazardous material:

The estimated activity of all reactor vessel components (including GTCC components that have been removed from the vessel and LLRW components) is the estimated activity on the previous date of September 1, 2000: approximately 809,000 curies.

The reactor vessel package of the RVTS will only contain LLRW meeting all 10CFR Part 61 requirements for disposal as LLRW. The reactor vessel package of the RVTS will contain LLRW. This LLRW includes reactor vessel internals that contain approximately 35,800 curies. **When these LLRW internals are combined with the reactor vessel, the reactor vessel package of the RVTS will consist of approximately 738,000 lbs. of activated metal containing approximately 40,700 curies: approximately 40,500 curies from activation products and approximately 190 curies from surface contaminants.**

The GTCC waste (which will not be included in the reactor vessel package of the RVTS) consists of about 37,400 lbs. of activated metal and contains approximately 769,000 curies. The GTCC components are the core barrel assembly, the lower core plate, and an 89 inch section of the lower core barrel that has resided in the active fuel region.

The GTCC components within the reactor vessel **have been** segmented **and removed from the reactor vessel. These GTCC components are stored at the HNP site.** GTCC components will not be included in the reactor vessel package of the RVTS.

Detailed description of the characterization of the reactor vessel and activated internal components is provided by the combination of: (i) the report "Haddam Neck Reactor Vessel and Internals Characterization" provided in the original application, dated March 30, 2000 and (ii) Addendum to the Characterization Report, Enclosure 3 of this application for modified exemption.

ATTACHMENT 1
REVISED COMPLIANCE MATRIX

EXEMPTION REQUEST FROM THE PACKAGING REQUIREMENTS OF 49CFR 173 FOR THE SHIPMENT OF THE HADDAM NECK PLANT (HNP) REACTOR VESSEL TRANSPORT SYSTEM

49CFR 107.105(c)(8):	An exemption is requested for the following shipment: The HNP reactor vessel with reactor internals approved as LSA-III material within a Canister and associated tie-down system, which is a non-specification package transported in accordance with a Transportation and Emergency Response Plan (TERP) which together comprise a Reactor Vessel Transport System. **Technical data concerning** the HNP Canister and its tie-down system **is provided by the combination of: (i) the Transport System Description Report (TSDR) provided in the original application, dated March 30, 2000 and (ii) Addendum to the TSDR, Enclosure 2 of this application for modified exemption. The Transportation and Emergency Response Plan is provided in the original application, dated March 30, 2000.**
49CFR 107.105(c)(9):	CYAPCO and its contractors will perform RPV transportation activities in accordance with their respective 10CFR Part 50 Appendix B, QA programs. As such, engineering evaluations, welding and preparation of the RPV for transport will be performed in accordance with the CYAPCO QA program. CYAPCO will provide oversight of the entire project.

ATTACHMENT 1
REVISED COMPLIANCE MATRIX

EXEMPTION REQUEST FROM THE PACKAGING REQUIREMENTS OF 49CFR 173 FOR THE SHIPMENT OF THE HADDAM NECK PLANT (HNP) REACTOR VESSEL TRANSPORT SYSTEM

49CFR 107.105(d)	*Justification of exemption proposal*
49CFR 107.105(d)(1):	A description of relevant shipping and incident experience follows: The Shippingport reactor vessel was successfully shipped to Hanford, Washington under DOE regulations. The Yankee Rowe reactor vessel was successfully shipped to Barnwell, South Carolina and the Trojan reactor vessel was successfully shipped to Hanford, Washington under NRC regulations (10CFR 71). The Saxton reactor vessel with internals was successfully shipped to Barnwell, South Carolina under a similar DOT exemption request (DOT E- 12114). Steam generators have also been successfully transported by land and water from Yankee Rowe, Salem, Trojan, Millstone, St. Lucie, **Maine Yankee, and the Haddam Neck Plant.**
49CFR 107.105(d)(2):	The Applicant is not aware of any increase in risk to safety or property that would result from issuing the requested exemptions.
49CFR 107.105(d)(3):	Either of the following, as applicable:
49CFR 107.105(d)(3)(i):	The applicant has designed the Canister in accordance with all the general design requirements specified in 49CFR 173.410 as well as the testing requirements 49CFR 173.465(c) and (d) within the limitations of the Transportation and Emergency Response Plan. The reactor vessel with internals is fully enclosed and grouted inside the Canister. [ ] The Canister within the RVTS was evaluated to confirm the capability, in accordance with Table 12 of 173.465, to safely withstand a free horizontal drop of the package from a height of 1 foot onto a flat non-yielding surface without loss of containment. Horizontal drop scenarios on either end from heights of 1 foot with a slap down of 2 feet at the opposite end were considered. **Technical data concerning these evaluations is provided by the combination of: (i) the Transport System Description Report (TSDR) provided in the original application, dated March 30, 2000 and (ii) Addendum to the**

	TSDR, Enclosure 2 of this application for modified exemption. These evaluations are conservative relative to the limitations of the Transportation and Emergency Response Plan. There are no other attachments or protrusions on the Canister, except structural cylindrical skirts at both ends designed to absorb energy in the event of a free drop with initial impact at the top or bottom. Compliance with the testing requirements specified in 49CFR 173.465 for the 1 foot horizontal drop calculations is demonstrated in accordance with 49CFR 173.461(a)(4). **Technical information concerning this analysis is provided by the combination of: (i) the Transport System Description Report (TSDR) provided in the original application, dated March 30, 2000 and (ii) Addendum to the TSDR, Enclosure 2 of this application for modified exemption.** Due to the physical configuration of the HNP reactor vessel and the intact vessel internal components within the Canister, this exemption request does not pose increased risk to the public health and safety since there is no credible scenario under normal transport conditions resulting in direct exposure to the Class 7 material included in the reactor internals components. A detailed discussion of the package design relative to the requirements of 49CFR 173 is provided **by the combination of: (i) the Transport System Description Report (TSDR) provided in the original application, dated March 30, 2000 and (ii) Addendum to the TSDR, Enclosure 2 of this application for modified exemption.** The package design and transportation plan with the requested exemptions and alternatives achieve a level of safety equal to or greater than that of an IP-2 package.
49CFR 107.105(d)(3)(ii):	This section is not applicable to this exemption request.

ENCLOSURE 2

ADDENDUM

TO

TRANSPORT SYSTEM DESCRIPTION REPORT

(TSDR)

HADDAM NECK PLANT

REACTOR PRESSURE VESSEL

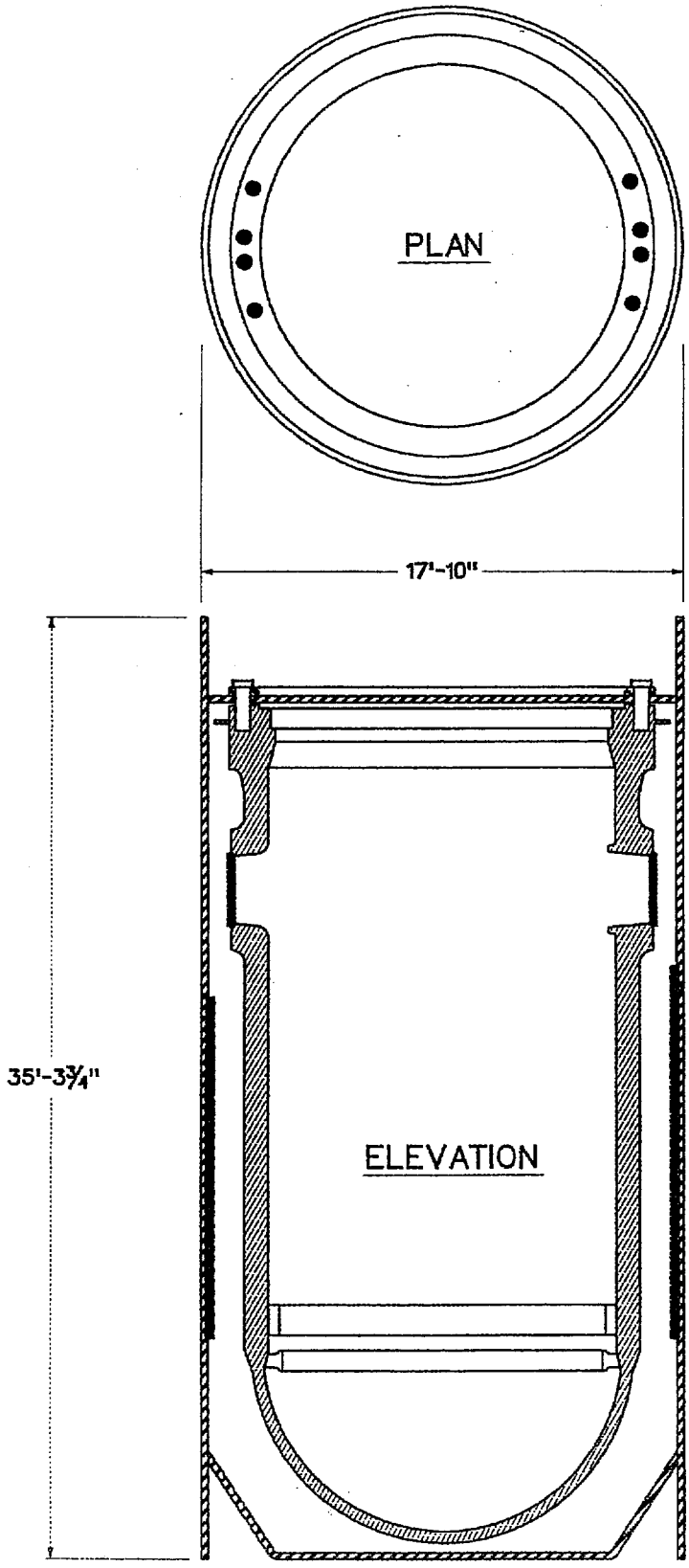
TSDR Section	Comments Concerning Reconfigured RVTS
1.2.1: Radioactive Contents & 1.2.2: Non-Radioactive Contents	Primary changes to the configuration of the Reactor Vessel Transport System (RVTS) are the absence of the following items that were previously planned for inclusion: • Reactor vessel closure head (absent as an attachment to exterior of canister) • Reactor vessel nozzles (absent from RVP package) • Reactor vessel insulation (absent from RVP package) The RPV package of the RVTS continues to include segmented metal components in the locations that are shown in Figure 1-1 of Report WMG 9919-9007, Revision 1,Transport System Description Report (TSDR). The total curie content is approximately 40,500 curies from activation products and approximately 190 curies from surface contaminants. As discussed in the commentary concerning TSDR Section 3.6.3, this value of 40,700 curies represents about 1,910 A2 quantities with average concentrations less than 0.4 percent of the LSA III materials limit.
1.2.3: Package	With the identified absence of closure head, vessel nozzles, and vessel insulation, the weight of the canister with its contents, including grout, is about 700 tons (Supplemental Reference #1, Bechtel Engineering Judgement Document 24265-200-30V-C12K-00012-000), rather than about 800 tons as previously reported. In the reconfigured RPV package, RPV closure studs are not used to attach the RPV to the canister. Rather, the position of the RPV in the canister is maintained by: (i) the nominal 70 lb/ft^3 low density cellular concrete (LDCC) in the bottom and annular regions of the canister and (ii) a six inch layer of nominal 120 lb/ft^3 structural grout at the top of the canister. The structural grout within the top of the canister also supports on-site rigging operations. On-site rigging operations include the use of eight rigging studs that pass through penetrations in the canister top plate and fasten to the upper flange of the RPV. Following the transfer of the loaded canister to the cradle of the RVTS, each of these eight rigging studs will be disabled by: (a) cutting off the stud flush with the shear ring attached to the top plate and (b) welding a three (3) inch thick carbon steel cap over the corresponding penetration in the top plate/shear ring. Each of the welded steel caps provides a metallic seal between radioactive contents and the environs. For each of the other canister top plate penetrations (corresponding to the previously planned attachment of the closure head), a steel plug or cover plate with a thickness of at least 3 inches will be welded into or directly over the penetration. Each of the welded steel plugs or cover plates provides a seal between the radioactive contents and the environs. With the application of these sealing devices, the reconfigured RVTS does not require and, consequently, does not include application of spray metalizing as a sealant.

TSDR Section	Comments Concerning Reconfigured RVTS
Figure 1-4: "HNP Package Shipping Configuration"	Addendum Figure 1 displays the reconfigured Package Shipping Configuration.
2.1: Materials of Construction	With the changes in radioactive content and packaging, the materials of construction of the RVTS do not include the following materials listed in Section 2.1 of the TSDR: • AISI-4340 (SA-193) – The reconfigured RVTS does not use the original RPV closure studs for package closure. • Spray Metalizing – The reconfigured RVTS does not use spray metalizing to seal closure studs around the package top. The materials of the reconfigured closures for package top penetrations are materials of construction that are listed in Section 2.1 of the TSDR. Specifically, these listed materials are ASTM A36 steel and weld materials specified as required per American Welding Society (AWS) D1.1 –1998, Structural Welding Code – Steel. Additionally, as described in the commentary concerning TSDR Section 1.2.3, a six inch layer of nominal 120 lb/ft^3 structural grout at the top of the canister supports on-site rigging operations.
2.5: Tie-down System	With the identified absence of closure head, vessel nozzles, and vessel insulation, the center of gravity of the loaded canister of the RVTS is different from the previously planned configuration. In order to more evenly distribute the footprint loads of the cradle, the canister is reversed in the RVTS cradle. An evaluation of the relevance of previous analysis to the reconfigured RVTS is provided by Supplemental Reference #1, Bechtel Engineering Judgement Document 24265-200-30V-C12K-00012-000.
2.5.1: Tie-down System Design Criteria and Analysis Results	Supplemental Reference #1 concludes that the previously referenced analyses for the tie-down system and the cradle are valid for the reconfigured RVTS.
Figure 2-1: "Tie-Down System"	Addendum Figure 2 displays the reconfigured tie-down system configuration.
3.1.6: General Design Requirements – Normal Transport Vibration (173.410(f))	Supplemental Reference #1 concludes that the previously referenced analyses of vibrational loads are valid for the reconfigured RVTS.
3.1.7: General Design Requirements – Chemical Compatibility (173.410(g))	As previously stated in regard to Materials of Construction, the reconfigured RVTS does not include either reactor vessel studs or spray metalizing.
3.2: Free Drop Under 173.465 (c) as per 173.411(b)	Supplemental Reference #3 is a re-evaluation of the original impact analysis using the updated configuration (changes in weight and Center of Gravity (CG)) as new physical input. The free drop (impact) re-evaluation found that (i) the original analysis assumptions remain valid and (ii) the package CG impact values increase from 5 to 15% over original values, resulting in little effect on the package. This conclusion is confirmed by the results of the Supplemental Reference #1 study, which used the new impact results as input to the package stress analysis. That engineering study found that resulting package stresses are either less than original values (due to the 12.5% weigh reduction) or continue to be within applicable code allowables. Therefore, the conclusions described in Section 3.2.1 of the TSDR remain valid.

TSDR Section	Comments Concerning Reconfigured RVTS
3.5: Thermal Evaluation	As stated in Supplemental Reference #2 (Bechtel Document No. 24265-100-V00-MV00-G0050-01), the reconfigured RVTS is consistent with the previously applied conduction model applied in analysis of thermal load for the package. In the applied model, the primary source of heat is radioactive decay of Co-60. In comparison to the segmented internals within the reactor vessel, the Co-60 contribution of the head, insulation, and nozzles was minimal.
3.6.3: LSA Limit Classification (including Table 3-1 "HNP Reactor Vessel Internals DOT Classification Summary" & Table 3.2 "HNP Bottom Core Barrel Section (41 inches) DOT Classification Summary"	In the original application for exemption, dated March 30, 2000, the total radioactive waste of the RPV package of the Reactor Vessel Transport System (RVTS) was categorized as 49 CFR – LSA III for transportation. The reconfigured RVTS does not include the following components which were previously included: • Reactor vessel closure head • Reactor vessel nozzles • Vessel insulation The RPV package of the RVTS continues to include the segmented metal components shown in Figure 1-1 of the TSDR. Consequently, the reconfigured RPV package contains 738,000 lbs. of activated metal (Supplemental Reference #2), rather than 939,000 lbs. The conservatively calculated value of total curie content remains the value that was calculated for shipment dates on or after September 1, 2000: 40,700 curies consisting of approximately 40,500 curies from activation products and approximately 190 curies from surface contaminants on components within the canister. Based on the weight of activated metal and the curie contribution from activation products, the average A2/g value for the reconfigured RPV package is approximately 5.71E-06. This value is less than 0.4 percent of the LSA III limit and only about 5.8 percent of the LSA II limit. With this average A2/g value, it remains valid to classify the package for transportation based upon the DOT classification summary for the worst case material within the package, the bottom core barrel section. As identified from Table 3-2 of the TSDR (which is unchanged), this material has an A2/g value of 1.57E-4, which is less than 8 percent of the LSA III limit. Therefore, the radioactive waste of the reconfigured RVTS remains categorized as 49 CFR – LSA III for transportation.

TSDR Section	Comments Concerning Reconfigured RVTS
4.0: Shielding Evaluation – Introduction Paragraph	Figure 4-1 of the TSDR is a Y-Z cross section of the modeled RPV and internals in their anticipated shipping configuration. As summarized in Supplemental Reference #2, the analytical results from the application of this shielding model are applicable to all geometric vectors from the reconfigured RVP package, including vectors that intersect the top of the canister, with its reconfigured penetration closures. The features of the reconfigured RVP package are: (a) no change to the geometry of the source material, (b) no changes to either the location or thickness (3") of the ALARA shield, (c) no change to the thickness or material of the top of the canister, and (d) penetration closures for the top of the canister that have dimensions which are consistent with the shielding provided by the 3" thickness of the canister top plate. The reconfigured RVTS does not include the reactor vessel head as an attachment to the exterior of the top of the canister.
4.3: Dose Rates from Package Exterior During Transport (173.441)	This section of the TSDR refers to calculated dose rates from the exterior of an anticipated RPV package on September 1, 2000. As stated in Enclosure 3, Addendum to the Reactor Vessel and Internals Characterization, for any later shipment date, the analytical assumptions and results corresponding to the earlier date continue to be valid.
4.3.1: Shielding Configuration & Figure 4-3 "HNP Reactor Vessel Package Shielding Configuration"	Addendum Figure 3, corresponding to Figure 4-3 of the TSDR report, shows the shielding configuration of the canister. As stated in Supplemental Reference #2, the analytical shielding model is consistent with the absence of the reactor vessel head from the exterior of the canister. Additionally, the closure devices for the top penetrations of the canister are consistent with the shielding contribution provided by the canister top plate.
5.0: Waste Classification Under 10 CFR Part 61 & Table 5-1, "HNP Reactor Vessel Internals NRC Part 61 Classification Summary"	As described in the original application, dated March 30, 2000, the 10 CFR Part 61 classification of the RPV package was determined by comparison of the evaluated classifications of individual components of the package. The original comparison of these classifications is described in "Haddam Neck Reactor Vessel and Internals Characterization Report" of the original application (referred to as the "Characterization Report.") Enclosure 3, Addendum to Characterization Report, supplements the comparison of these classifications. Although not applied for actual classification, Section 5.2 of the TSDR provides an alternative classification summary that does not distinguish between components within the package. The cumulative waste weight in the reconfigured RPV package is 738,000 pounds (Supplemental Reference #2). In comparison, the applied waste weight value in TSDR Table 5-1 was 800,000 pounds. The ratio of the previously assumed waste weight to the reconfigured waste weight is 1.084. The cumulative waste volume in the reconfigured RPV package is 1,475 cubic feet (Supplemental Reference #2). In comparison, the applied waste volume value in Table Figure 5-1 was 1,600 cubic feet. The ratio of the previously assumed waste volume to the reconfigured waste volume is 1.085. (continued)

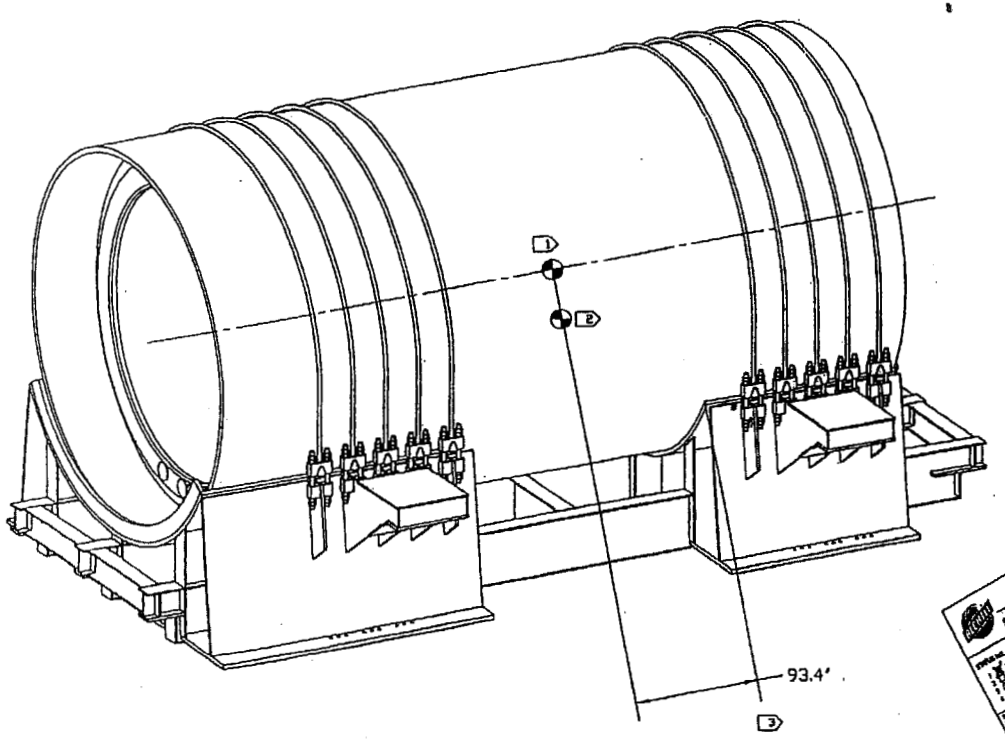
TSDR Section	Comments Concerning Reconfigured RVTS
5.0: Waste Classification Under 10 CFR Part 61 & Table 5-1, "HNP Reactor Vessel Internals NRC Part 61 Classification Summary" (continued)	(continuation) Consequently, in determining a bounding degree of possible change in 10 CFR Part 61 Table Fractions from the alternative classification summary of TSDR Table 5-1, a multiplication factor of 1.085 is applicable. The resulting postulated 10 CFR Part 61 Table 1 and Table 2 Fractions remain bounded by the corresponding calculated values for HNP Bottom Core Barrel Section (41 inches) (TSDR Table 5-2). However, as stated in Section 5.0 of the TSDR, "concentration averaging will not be employed." Rather, as previously stated, the 10 CFR Part 61 classification of the RPV package is determined by comparison of the evaluated classifications of individual components of the package.
6.0: References	The references listed in the TSDR are supplemented by the following documents: • Supplemental Reference #1: Bechtel Engineering Judgement No. 24265-200-30V-C12K-00012-000, dated October 22, 2001. • Supplemental Reference #2: Bechtel Document No. 24265-100-V00-MV00-G0050-01, WMG letter dated October 17, 2001. • Supplemental Reference #3: Bechtel Document No. 24265-100-V00-MV00-G0051-01, WMG letter dated October 18, 2001. • Supplemental Reference #4, Bechtel Document No. 24265-100-V00-MV00-G0048-02, WMG letter dated June 7, 2001.
Appendix A: HNP Cradle Assembly Drawing	Addendum Figure 2 displays the reconfigured cradle and tie-down system configuration.
Appendix B: Sketch – Typical Land Transport Configuration	Addendum Figure 4 replaces the sketch from Appendix B of the TSDR.
Appendix C: Sketch – Typical Barge Transport Configuration	Addendum Figure 5 replaces the sketch from Appendix C of the TSDR.

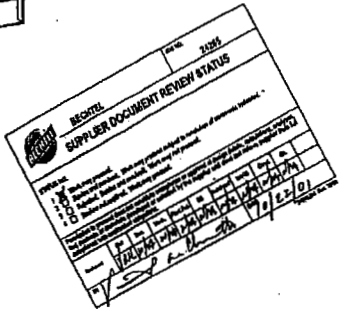


HNP Package Shipping Configuration

ADDENDUM FIGURE 1

1. CENTER OF GRAVITY (PACKAGE) 93.4" FROM INNER FACE OF SADDLE
2. CENTER OF GRAVITY (COMBINED PACKAGE AND CRADLE ASSEMBLY) 93.7" FROM INNER FACE OF SADDLE
3. DIMENSION FROM INNER FACE OF SADDLE.





Packaging Technology, Inc.
A Transnuclear Company

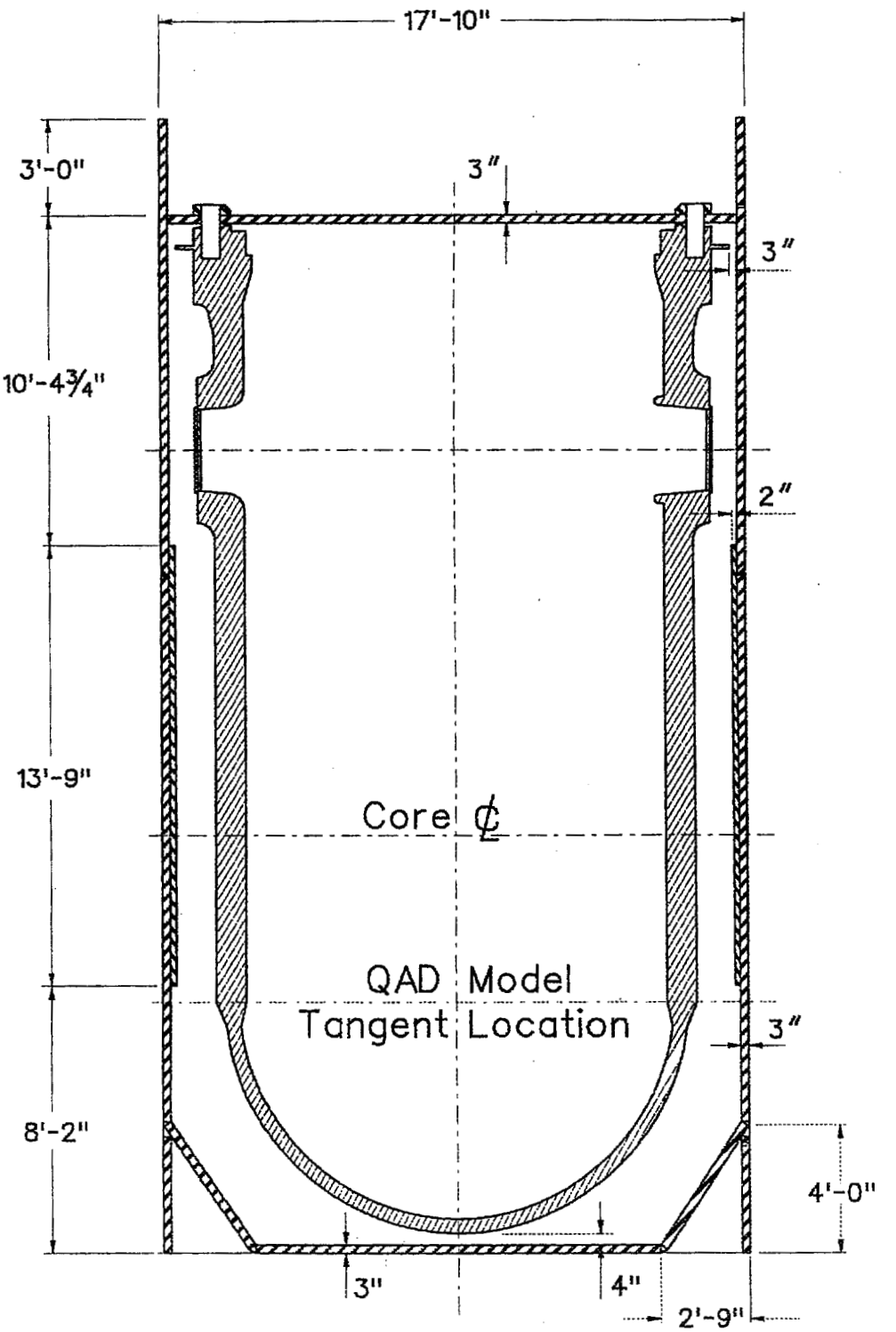
RVP/CRADLE ASSEMBLY
CONNECTICUT YANKEE

SCALE: X WT. X
REV: X SHEET X OF X
DWG SIZE B DWG NO. SK-117
CADFILE X

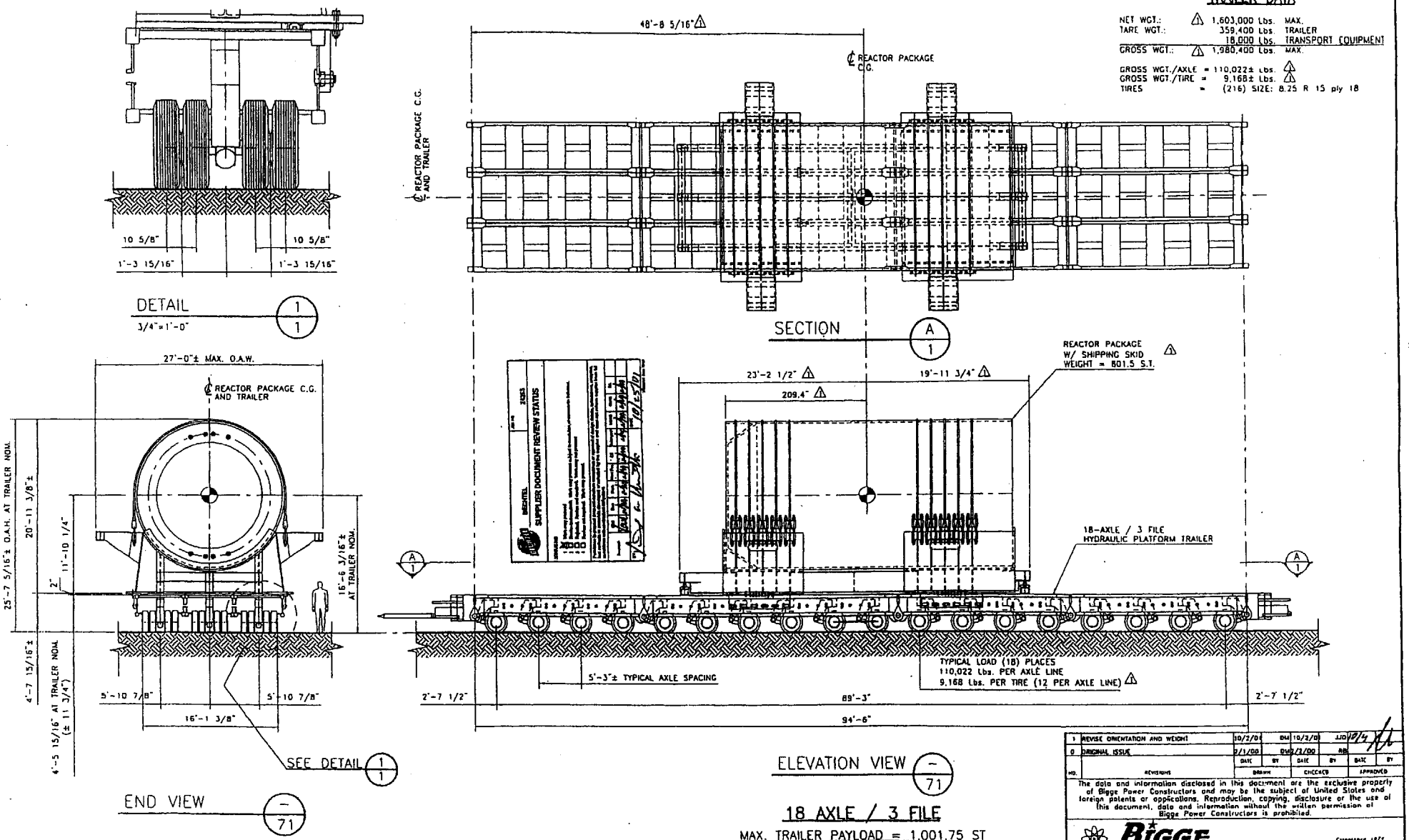
24265-100-V00-mv00-G0052-01

ADDENDUM FIGURE 2

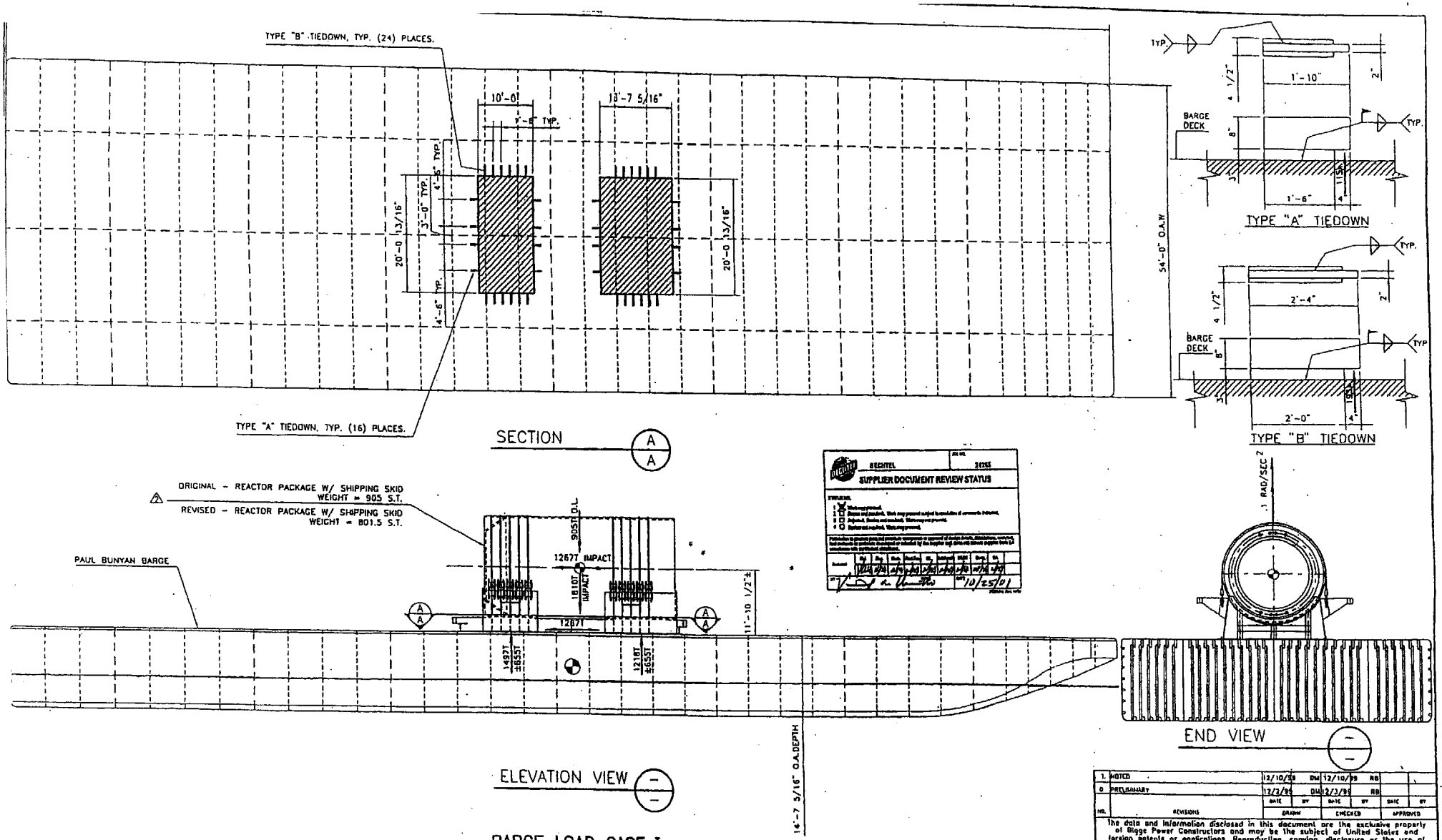
HNP Reactor Vessel Package
Shielding Configuration



ADDENDUM FIGURE 3



ADDENDUM FIGURE 4



BARGE LOAD CASE I

HEAD SEAS
ANSI N14.24

⚠ NOTES:

1. TIE DOWN STRESSES 90% YIELD USING APPROPRIATE YIELD - TENSION, COMPRESSION SHEAR, ALSO 90% CRITICAL BUCKLING LOAD.
2. 2·(905) = 1810T VERTICAL IMPACT DOWN
   1.4 (905) - 1267T LONGITUDINAL IMPACT.
3. ⚠ ORIGINAL LOAD VALUES STILL SHOWN
   REVISED LOADS LESS THEN THOSE SHOWN AND VERIFIED IN APPROPRIATE CALCULATION PACKAGE. 242165-100-V00-HCRA-G0037-02

NO.	REVISIONS	DRAWN	CHECKED	APPROVED
1	NOTED	12/10/01 DM	12/10/01 RB	
0	PRELIMINARY	12/3/01 DM	12/3/01 RB	

BIGGE POWER CONSTRUCTORS Established 1974

BARGE LOAD CASE I
"PAUL BUNYAN" BARGE
R.P.V. TRANSPORT
CONNECTICUT YANKEE DECOMMISSIONING

SCALE	ENGR. No.	DWG. No.	SHEET	REV.
1/8" = 1'-0" ARB no 2002	99E30	SK99-12-06-02	1 of 5	2

2 REVISE ORIENTATION AND WEIGHT 10/2/01 DM 10/2/01 JJO 10/2/01

M:\JOBS\1999\99E30\SKETCHES\SK99-12-06

ADDENDUM FIGURE 5

ENCLOSURE 3

ADDENDUM

TO

REACTOR VESSEL and INTERNALS

CHARACTERIZATION REPORT

HADDAM NECK PLANT

REACTOR PRESSURE VESSEL

Report Section	Comments Concerning Reconfigured RVTS
2.1: Estimated Component Radioactivity and Classification Status – Overview & TABLE 2-1 "Haddam Neck Component Activity Part 61 Table"	In the original application for exemption, dated March 30, 2000, the total radioactive waste of the RPV package of the Reactor Vessel Transport System (RVTS) was categorized as 10 CFR 61 Class C for disposal. The reconfigured RVTS (which includes the RPV package) does not include the following components which were previously included: • **Reactor vessel closure head** (considered in identifying weights for "Reactor Vessel" and "Vessel Cladding" as reported in Table 2-1 of the Characterization Report) • **Reactor vessel nozzles** (considered in identifying weight for "Reactor Vessel" as reported in Table 2-1 of the Characterization Report) • **Vessel insulation** (considered as a distinct contributing weight in Table 2-1 of the Characterization Report) The RPV package of the reconfigured RVTS continues to include the segmented metal components that are: (a) identified as "LLRW to be Disposed of Intact Within the Reactor Vessel" from Table 2-1 of the Characterization Report, and (b) located in the RPV package as shown in Figure 1-1 of the Transport System Description Report (TSDR) In considering both average and specific values of activity of components within the reconfigured RPV package, it is conservatively assumed that the previously calculated values (September 1, 2000 basis) continue to be applicable. The 10 CFR Part 61 classification for either the originally-planned RPV package or the reconfigured RPV package is determined by comparison of the evaluated classifications for individual components of the package. As listed in Table 2-1 of the Characterization Report, the activated components of the originally-planned RPV package were: • Top Core Barrel Section (151") • Upper Core Plate • Upper Internals (excluding Upper Core Plate) • Lower Internals (excluding GTCC Lower Core Plate) • Bottom Core Barrel Section (41") • Vessel Cladding • Reactor Vessel • Vessel Insulation As previously noted, the changes between the originally planned RPV package and the reconfigured RPV package are reductions in the weights and volumes of the last three of the listed components. Section 2.2.5 "Reactor Vessel Assembly" of the Characterization Report addresses specific characterizations for these three components. This Addendum includes separate commentaries concerning these components. (continued)

Report Section	Comments Concerning Reconfigured RVTS
2.1: Estimated Component Radioactivity and Classification Status – Overview & TABLE 2-1 "Haddam Neck Component Activity Part 61 Table" (continued)	(continuation) The 10 CFR Part 61 classification of the Bottom Core Barrel Section (Table 2-6 of the Characterization Report) continues to provide a characterization that bounds the specific characterizations of the other distinct components in the reconfigured RPV package. The Table 2-6 characterization corresponds to the Table 2-1 classification of 10 CFR 61 Class C.
2.2.5.1: Component Radioactivity – Reactor Vessel Assembly – Reactor Vessel and Closure Head & 2.2.5.2: Component Radioactivity – Reactor Vessel Assembly – Stainless Steel Vessel Cladding	The weight of the reactor vessel within the reconfigured RPV package is 613,782 pounds (information from Supplemental Reference #2, Bechtel Document No. 24265-100-V00-MV00-G0050-01 and Supplemental Reference #4, Bechtel Document No. 24265-100-V00-MV00-G0048-02). The ratio of the previous weight in characterization calculations (787,000 pounds as stated in Table 2-10) to the reconfigured weight is approximately 1.3. It is conservative to assume that this same value (1.3) is applicable to the ratio of the volume in the previously planned configuration to the volume of reactor vessel waste in the reconfigured package. When a multiplication factor of 1.3 is applied to the Part 61 Table 1A Fraction and the Part 61Table 2A Fraction of Table 2-10, the characterization results from Table 2-6 "Bottom Core Barrel Section Characterization Results" continue to provide the bounding characterization. The Table 2-6 characterization corresponds to the Table 2-1 classification of 10 CFR 61 Class C. The weight of the reactor vessel cladding within the reconfigured RPV package is 8500 pounds (Supplemental Reference #2). The ratio of the previously applied value in characterization calculations (10,200 pounds as stated in Table 2-11) to the reconfigured weight (8500 pounds) is 1.2. It is conservative to assume that this same value (1.2) is applicable to the ratio of the volume in the previously planned configuration to the volume of the cladding in the reconfigured package. When a multiplication factor of 1.2 is applied to the Part 61 Table 1 B fraction and the Part 61 Table 2 B Fraction of Table 2-11, the characterization results from Table 2-6 "Bottom Core Barrel Section Characterization Results" continue to provide the bounding characterization. The Table 2-6 characterization corresponds to the Table 2-1 classification of 10 CFR 61 Class C.
2.2.5.3: Component Radioactivity – Vessel Mirror Insulation	The reconfigured RPV package does not include any weight contribution from Vessel Mirror Insulation.
Addendum 1 – Estimated Surface Contamination	As previously stated, the reconfigured RVTS does not include the reactor vessel closure head. Therefore, the information from Section 4.0 "Reactor Vessel Head" of Addendum 1 is not applicable to the transport of the reconfigured RVTS. The absence of the reactor vessel head does not affect either (i) the estimate of total surface contamination (about 190 curies) for the reactor vessel and contained internals (reported in Section 2.0 of Addendum 1 or (ii) the estimate of surface contamination for the bottom core barrel section (reported in Section 3.0 of Addendum 1.)